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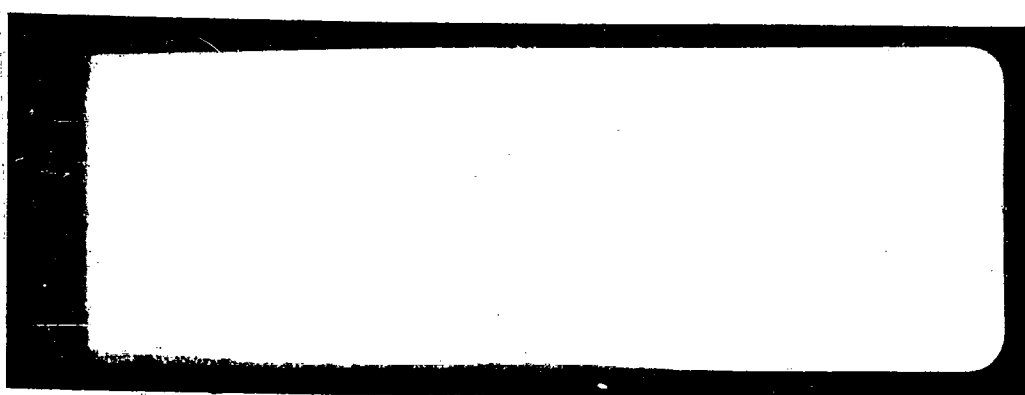
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**SPECIAL DEVICES CENTER**  
**PORT WASHINGTON, L.I., N.Y.**

TECHNICAL REPORT - SPECDEVCEM 104-2-37

RELATIONSHIPS BETWEEN CERTAIN ASPECTS  
OF PERSONALITY AND SOME VOCAL EFFECTS OF DELAYED  
SPEECH FEEDBACK

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## FOREWORD

### Purpose

It is not an unusual occurrence to observe changes in the speech patterns of certain individuals under conditions of stress. However, this phenomenon becomes critical in many military situations particularly where tactical operations are involved. The degree to which speech intelligibility is reduced under stress conditions varies for different individuals. One important variable which seems to contribute to reduced speech intelligibility is the personality characteristics of the communicator. It is an investigation of the degree of relationship between certain personality traits and several speech variables which is the objective of this study.

In this study, stress upon the vocal process was produced by auditory feedback, i.e., by transmitting an individual's speech back to his ears at a fraction of time later than when the message was spoken. The personality traits and voice variables chosen for study were:

Personality Traits	Speech Variables
1. Self-percept Stability	1. Average Syllable Duration
2. Schizoid tendencies	2. Percent Phonation Time
3. Paranoid tendencies	3. Mean Vocal Intensity
4. Rigidity	4. Vocal Intensity Variance

### Results

The results obtained from 129 subjects can be summarized as follows:

1. Of the variables studied, the amount of change occurring in Vocal Intensity Variation due to delayed speech feedback appears to be the most closely related to personality functioning.

2. Increases in Vocal Intensity Variation appear to be positively related to Self-percept Stability and Paranoid tendencies and negatively related to Rigidity.

3. Decreases in Vocal Intensity Variation appear to be positively related to Schizoid forms of behavior.

### Implications

The results of this study indicate that variations in speech under conditions of delayed feedback can be partially accounted for by certain personality factors. This finding should prove valuable for the selection and training of personnel required to perform duties involving voice communication. In addition, investigation of personality variables other than those included in this study should be considered.

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## BRIEF OF THE STUDY

### Introduction

A survey of the literature on psychological stress reveals a surprising lack of research on one of man's most apparent and evident modes of adjustment, namely vocalization as expressed through speech content and voice qualities. The literature on emotion, stress, and vocal response is voluminous and may be traced without much difficulty as far back as to Plato. An exhaustive survey of the literature in this area has revealed only relatively few research studies relating stress and vocalization. In one of these investigations which was conducted in 1934, Waggener (26) found that speakers rated as inferior revealed more emotional disturbance than speakers rated good, when talking before an audience. Performing before an audience has often been regarded as stress producing. A direct study of speech and voice under stress conditions was reported by Baker and Harris (1) in 1948. They found that a stress condition of mild electric shock to speakers communicating over high level noise tended to reduce speech intelligibility, shorten syllable duration, and increase vocal intensity variation. Utilizing a sample of 14 subjects, they obtained evidence which indicated that certain personality characteristics were related to the observed vocal changes.

The present study represents an attempt to further such investigation by observing some vocal accompaniments of stress when the focus of the stress is apparently on the speaking process itself. In addition, an attempt is made to predict the direction of any relationships which might obtain between the vocal and personality variables studied.

### Rationale

The technique used here to induce stress upon the vocal process has been variously termed delayed speech, side-tone, or auditory feedback, and basically consists of transmitting an individual's speech side-tone back to his ears at a time delay usually from .03 to .40 second instead of the .001 second delay that normally occurs. The vocal effects of such a delay in auditory feedback appear as speech sound repetitions, prolongations, blocks, and measurable changes in pitch and loudness. Cutler (3), in a recent study concerning stress effects on time perception, successfully employed delayed feedback as a means of producing stress. From Cutler's observations of subjects, it would appear that this technique produces a rather severe stress situation in the sense that the subject suddenly finds that one aspect of his behavior, previously under almost complete control, now can be controlled only within gross limits at the expense of considerable effort.

When a person is subjected to a delayed speech feedback condition and instructed to speak in his normal manner, he may vary in his ability to control his speech all the way from complete maintenance of his everyday pattern to a total inability to make more than incoherent sounds. It was believed that this great variation might be partially accounted for by personality factors. To test this position, the following rationale and hypotheses were developed.

One of the most frequently cited explanations by subjects capable of withstanding the influences of feedback is that one must be able to avoid being influenced by the auditory stimuli and at the same time concentrate on or "feel" his speech. These subjects believe they maintain normal speech patterns by kinesthetic rather than auditory speech cues. In developing an explanation for the apparently great individual variation in ability to attend to kinesthetic speech cues, the position is taken that all adjustment is, in part, a function of a balance between attention to external and internal cues and the ability to vary such attention as conditions change. In other words, a person must attend, to a certain degree, to both externally and internally produced cues to effect optimal adjustment. For example, a withdrawn introverted type of adjustment may result from a chronic over-emphasis on internally produced cues whereas hypomanic extroversion may be an extreme expression of abnormal responsiveness to external cues. It is thus hypothesized that the manner and degree to which speech and voice are altered by delayed sidetone are a function of (1) emphasis on either exteroceptive (auditory) cues or the proprioceptive (kinesthetic) cues of speech, and (2) the ability to shift from one set of these cues to the other. An examination of the literature on personality brought to light a number of individual characteristics, apparently closely related to the vocal effects of delayed speech feedback.

The personality traits chosen for study as well as the tests measuring these traits are described in detail in Appendices A and B, respectively, and are summarized as follows:

1. Self-percept stability which is the degree to which the individual remains relatively constant in his own self views. The California Test of Personality was chosen to obtain a measure of this trait. This test is designed to measure 12 aspects of personal and social adjustment. The Inventory of Factors STDCR was also employed as a test of adjustment and self-percept stability.

2. Schizoid tendencies which have been variously listed as unsociability, introversion, autism, constriction and withdrawal. This trait was measured by the Schizophrenia (Sc)

sub-scale of the Minnesota Multiphasic Personality Inventory. However, the Social and Thinking Introversion scales of the Inventory of Factors STDCR may also tap the area of schizoid traits (11). A similar interpretation may be made of the withdrawing tendencies sub-scale of the California test.

3. Paranoid tendencies which are characterized by delusional systems and tend to over-emphasize environmental changes as real or imagined threat from the outside world becomes imminent. This trait was measured by the Paranoia (Pa) sub-scale of the Minnesota Multiphasic Personality Inventory.

4. Rigidity which is manifested by the individual's resistance toward altering his behavioral reactions in changing situations. On the basis of various investigations relating ethnocentrism and behavioral rigidity (10, 22), the Total Ethnocentrism Scale was chosen to measure rigidity. Based on the assumption that individuals with strong convictions (non-ethnocentric) will tend to be more rigid than those who feel less intensely on the subject, rigidity was evaluated in terms of the number of extreme agreements and disagreements with the ethnocentric items. The total number of extreme responses was also computed.

The voice variables included in this study were: (1) Average Syllable Duration, (2) Percent Phonation Time, (3) Mean Vocal Intensity, and (4) Vocal Intensity Variance. These voice measures are expressed as difference scores, i.e., the amount of change which occurred in the individual's voice due to the effects of the delayed speech feedback condition. Consequently, these measures consist of the scores obtained for the synchronous feedback condition subtracted from the corresponding scores obtained under delayed speech feedback.

Phonation time was recorded directly by the Purdue Speech Sound Timer. A Percent Phonation Time measure was computed by dividing phonation time by the total speaking time and expressing the result as a percent. An indication of Average Syllable Duration was obtained by dividing the individual's phonation time by 93 which was the number of dictionary syllables in the reading passage.

Mean Vocal Intensity above an arbitrary reference level and Variance of the Vocal Intensity peaks were obtained from the paper tapes of the HPL-E level recorder. These scores were calculated on the basis of each entire reading of the passage.

#### Procedure

The subjects employed in this investigation were 129 male students ranging in age from 13 to 27 years. All were from a basic speech course at Purdue University. The subjects were

taken individually into the sound-treated laboratory so that speech samples could be obtained under experimental conditions. The instruments and operation of the circuits which were used for recording and measuring these speech samples are shown in Figure 1 and are described in detail in Appendix C.

Each subject was seated at a desk upon which was clamped the Altec 21B microphone between three and four inches from the subject's mouth. The subject was instructed to maintain this distance at all times during the testing periods. A pair of ANB-H-1 headphones mounted in a helmet and connected to the feedback channel of the circuit was worn by the subject. Thus, the side-tone was received primarily through the headset. The passage to be read was placed on a clipboard situated directly in front of the subject and slightly above the microphone. The reading material used consisted of a 73 word phonetically balanced passage.

Following the initial seating and instruction of the subject, the experimenter directed the experiment from another sound-treated room which contained the feedback and recording equipment. Contact with the subject was maintained by means of a microphone which was connected through channel 5 of the McIntosh amplifier to the headphones. The remaining instructions were communicated to each subject through this system.

During a preliminary reading of the passage, the experimenter manipulated the gain control for the Magnecord amplifier so that the majority of the subject's vocal intensity peaks fell between the -1 and +1 index on the VU meter. This procedure was designed to achieve a certain consistency of the signals recorded on the sound timer and power level recorder.

Following this first reading of the passage, the subject was instructed to reread it. As the subject completed an introductory phrase to the passage, the experimenter set the power level recorder and the sound timer in operation. When the subject finished reading the complete passage, these instruments were shut off, the dial readings of the timer were recorded, and the tape was removed from the power level recorder. The first two readings of the passage were conducted under conditions of synchronous feedback. A third reading was then conducted under the condition of delayed feedback. Before this reading, the subject was given instructions similar to those of the first two readings, with the addition of a warning that on this trial he might experience some difficulty in reading. The subject was told not to stop reading nor to laugh when experiencing difficulty.

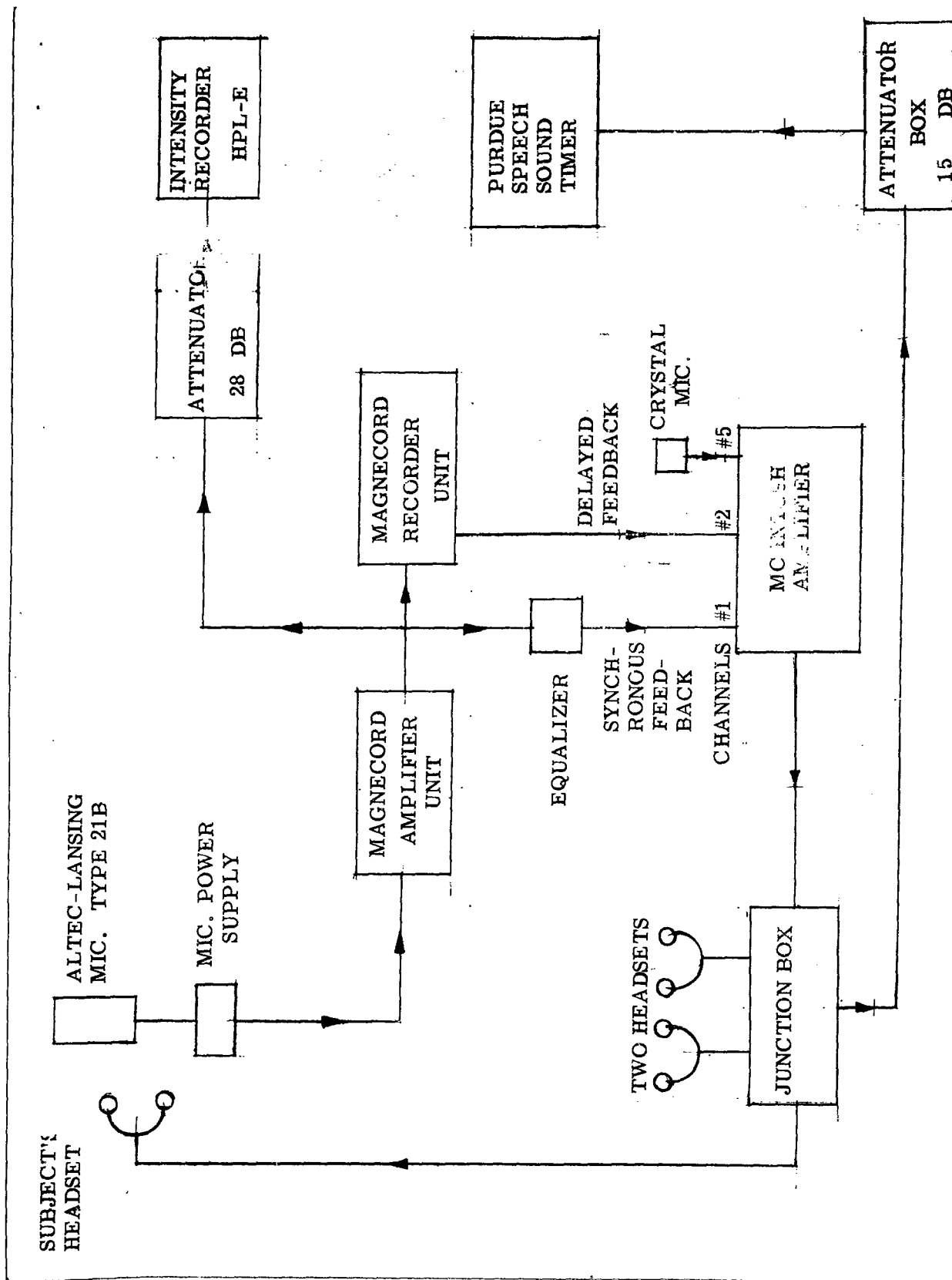


FIGURE 1. BLOCK DIAGRAM OF SYNCHRONOUS AND DELAYED SPEECH FEEDBACK  
CIRCUITS AND INSTRUMENTATION FOR VOICE VARIABLE MEASUREMENTS

The McIntosh feedback control was set to the delayed feedback channel, and as the subject read, recordings of his vocal rate and intensity were taken again. At the completion of this reading, the subject was informed that the testing period was over. He was then requested not to tell future subjects about the experiment and was dismissed. This procedure was followed for all 129 subjects who participated in this study. Following the experimental sessions, the subjects were given four personality scales to fill out.

### Results

The data were analyzed to determine the relationships between the voice and personality variables under conditions of synchronous and delayed feedback. In analyzing Vocal Intensity Variance, the subjects were divided into two groups: 99 subjects who revealed an increase in Vocal Intensity Variance under delayed feedback; and 30 subjects whose Vocal Intensity Variance decreased. Where further analysis appeared fruitful, various combinations of the personality measures were formed to determine the best predictors of a physical voice change. The results and treatment of the data are presented in detail in Appendix D and may be summarized as follows:

1. Of the voice variables studied, the amount of change occurring in Vocal Intensity Variation due to delayed speech feedback appears to be the most closely related to personality functioning. Changes in the investigated voice variables due to delayed speech feedback other than those which occurred in Vocal Intensity Variation cannot be asserted to be reliably associated with any of the measured aspects of personality.
2. Increases in Vocal Intensity Variation under conditions of delayed speech feedback appear to be positively related to:
  - a. Inadequacy and instability of the self-conceptual system as indicated by measures which reveal negative self-attitudes and poor general personality adjustment.
  - b. Paranoid behavioral tendencies.
3. Increases in Vocal Intensity Variation under conditions of delayed speech feedback appear to be negatively related to rigidity as indicated by the degree of ethnocentric and/or non-ethnocentric beliefs.
4. Decreases in Vocal Intensity Variation under conditions of delayed speech feedback appear to be significantly and positively related to schizoid, socially withdrawing and isolating modes of behavioral adjustment.

## APPENDIX A

### DESCRIPTION OF PERSONALITY TRAITS

#### Self-percept Stability

According to the theoretical formulations of Lecky (16), Raimy (20), and others (13, 15), there is implicit in all behavior an evaluation or concept of the self. To Raimy (20), this principle is that "the self concept is the map which each person consults in order to understand himself during moments of crisis or choice (page 154)."

Research on self percepts (2, 5, 19) has shown that negative self attitudes are associated with similarly undesirable views of the world and a general neurotic type of adjustment. Stagner (23) and others (4, 12) have demonstrated that such maladjustment and negative self percepts are often related to an apparent instability of the individual's self-conceptual system which is manifested by relatively great variability on one's self views.

The hypothesis is advanced here that this variability of reaction is a function of sensitivity to environmental changes, and that the individual reacts in an apparently unstable manner in order to cope with the changes he perceives in his surroundings. Highly accentuated exteroception is thus one form of defense for an unstable and inadequately functioning self-conceptual system. With respect to vocal responses to delayed auditory feedback, it is hypothesized that such an individual will attend compulsively to the incoming (exteroceptive) auditory signals to the detriment of attendance to kinesthetic speech cues and thus, will demonstrate considerable vocal change. In other words, degree of vocal change under delayed feedback is negatively related to the level of self and social adjustment.

#### Schizoid Tendencies

In the preceding section, discussion was mainly concerned with personality characteristics which, it is hypothesized, relate positively to the amount of vocal change occurring under conditions of delayed speech feedback. The opposite situation is hypothesized in the case of those characteristics labeled as schizoid. The traits of schizoid individuals have been variously listed as unsociability, introversion, autism, etc. One schizoid trait which Kretschmer (14) and others (6, 10, 17) have emphasized is the ability of schizoid persons "to concentrate more on certain characteristics of the stimulus to the neglect of all others" (14, p. 122). The defenses of such a person appear to be reorganized in such a manner that stress conditions might serve to increase the tendencies to encapsulate.

This, combined with the tendency to respond to internally produced cues in preference to those from the outside world, suggests that these persons, when subjected to delayed feedback, may be able to concentrate on the speech disturbing influences of the delayed side-tone condition. In other words, a negative relationship is hypothesized between the presence of schizoid characteristics and the degree of vocal change occurring under a delayed feedback condition. Since constriction and withdrawal are often noted as schizoid traits, it may also be hypothesized that such methods of reaction may result in such responses to delayed feedback as a reduction in vocal intensity or the development of monotonous vocal characteristics.

### Paranoid Tendencies

Discussions of paranoid characteristics (6), emphasize the importance of projection in maintaining the paranoid delusional system. Associated with this tendency to externalize one's difficulties appears to be an over-emphasis on environmental changes as real or imagined threat from the outside becomes imminent. A study by Wright (27) suggests that stress will tend to increase such projective and externalizing tendencies. In the present frame of reference, the theoretical position is advanced that under the stress conditions of delayed feedback certain individuals, to the extent that they utilize paranoid defenses, will be unable to attend to the kinesthetic cues of speech. This will occur because of an increase in the tendency to focus on external influences. It is thus hypothesized that positive relationships will obtain between the degree of vocal change manifested under the delayed feedback condition and the prevalence of paranoid modes of thought and behavior.

### Rigidity

The available research on personality rigidity indicates that persons subjected to stress conditions will, to the extent that their usual behavioral reactions are rigid and maladaptive, reveal a "looseness and breakdown" in their defenses (9 p. 34). Beier (3) also found evidence that anxiety appears to effect a disorganization in the perceptual field. What these and other researchers suggest is that the rigid person may find his rigidity maladaptive in a stressful situation. As his defenses prove inadequate, his behavior becomes somewhat chaotic. To the degree that delayed speech feedback is stress producing to the extent that an individual possesses rigid modes of defense, it is hypothesized that his vocal behavior will be changed. In other words, his vocal responses will reveal "looseness and breakdown" as his speech is severely affected by the delayed speech feedback condition.

## APPENDIX B

### MEASUREMENT OF PERSONALITY TRAITS

#### The California Test of Personality, Secondary Series

This test was designed for testing older adolescents and adults. It is composed of 180 yes-no type of questions, which when considered together contribute to a Total Adjustment score. Ninety of these questions are designed to sample six areas of Self Adjustment, while the remaining 90 items relate to six areas of Social Adjustment. Thus, a Self Adjustment and a Social Adjustment score are provided. Each of these two scale sections is further divided into six sub-scales of 15 items each, permitting computation of 12 sub-scale scores, making a total of 15 possible adjustment indicators for the total test. The measures provided by this test include the following:

#### TOTAL ADJUSTMENT (180 Items)

##### SELF ADJUSTMENT (90 Items)

Self-reliance  
Sense of personal worth  
Sense of personal freedom  
Feeling of belonging  
Withdrawal tendencies  
Nervous Symptoms

##### SOCIAL ADJUSTMENT (90 Items)

Social standards  
Social skills  
Anti-social tendencies  
Family relations  
School relations  
Community relations

All 15 of these adjustment scores have been employed in the present investigation. Raw scores were used, although the test manual provides conversion factors for determining percentile equivalents.

#### An Inventory of Factors STDCR

This scale is composed of 175 objective question-answer items which are designed to sample five areas of general adjustment, namely, (1) Social Introversion (S), (2) Thinking Introversion (T), (3) Depression (D), (4) Cyclothymia (C), and (5) Rhathymia (R). All five of the scores obtained for these factors have been employed in the present study as means of providing measures of general adjustment and personality integration.

### The Total Ethnocentrism Scale (Public Opinion Questionnaire)

This examination, as employed in the present investigation, was made up of 22 objective-type test items, the answers to which were to be given in terms of three degrees of agreement or three of disagreement with the statement in question. A total score for the scale was computed by algebraically summing the +1 to +3 scores which indicated agreement with the statement and the -1 to -3 tallies which revealed disagreement. Because of the relationships studied in the present investigation, three additional scores indicating intensity of belief were computed. These were the total number of +3's, the total number of -3's, and the total number of 3's, as tallies of 3's indicated extreme views with regard to the statement being considered.

A large number of studies validating this scale has been conducted, the results of which have quite conclusively demonstrated high validity coefficients for this test as a measure of certain personality trends. One such relationship which has been tested a number of times is between ethnocentric ideology and behavioral rigidity, (22), and it is in this capacity that the present investigation employs the Total E-Scale. Since it has been shown that ethnocentrism and rigidity are positively related, it was decided to investigate the hypothesized relationships between rigidity and the vocal effects of delayed feedback by means of responses made to the E-Scale. Because of the scoring technique employed here, it is to be expected that the total score on the E-Scale will correlate positively with rigidity in the subject. It is also believed that the more intense believers, whether they be ethnocentric or non-ethnocentric, will tend to be more rigid than those who believe less intensely with regard to the statements of the scale.

### The Paranoia (Pa) and Schizophrenia (Sc) Scales of the Minnesota Multiphasic Personality Inventory (MMPI)

One of the most widely used and investigated objective question-answer scales for personality measurement is the Minnesota Multiphasic Personality Inventory. The only sub-scales of the MMPI which were pertinent to the present investigation were the Paranoia (Pa) and Schizophrenia (Sc) subtests.

## APPENDIX C

### INSTRUMENTATION AND LABORATORY ARRANGEMENT

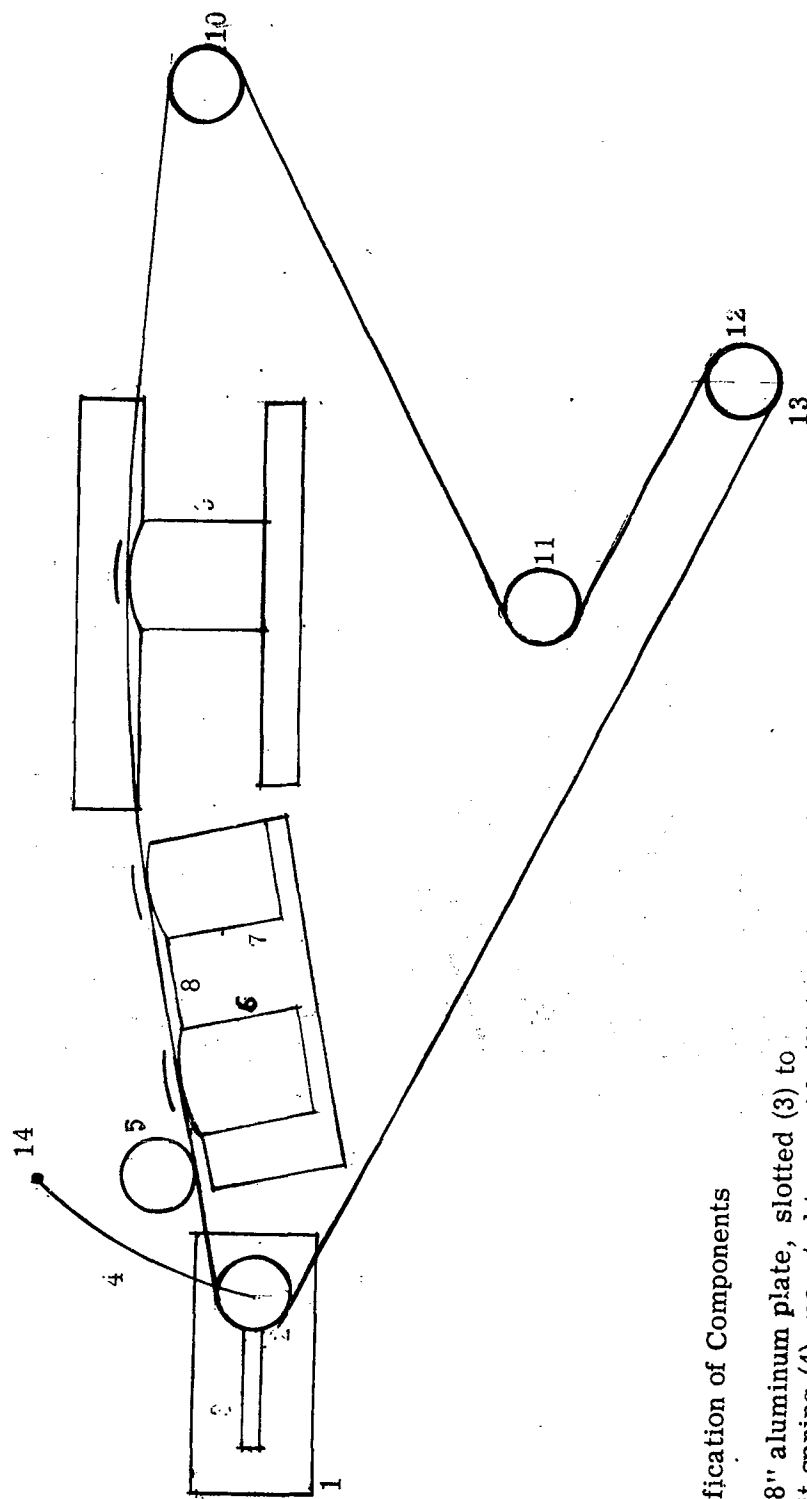
The instruments which were used for recording and measuring the speech samples studied in this investigation were: (1) a Magnecord Corporation high fidelity magnetic tape recorder with type PT6-AH recording unit and type PT6-J amplifier. This instrument was modified so that it could be employed for delayed feedback research. The complete unit is known as the Magnecorder; (2) a McIntosh Engineering Laboratory amplifier type 20W-2 and McIntosh amplifier equalizer unit type AE-2A; (3) an Altec Lansing Corporation M11 microphone system with Altec 21B miniature condenser microphone; (4) two Hewlett-Packard Corporation 110-decibel single-step attenuators, model 350A; (5) a Sound Apparatus Company High Speed Power Level Recorder, Model HPL-E; (6) Purdue Speech Sound Timer; (7) three headsets, type ANB-H-1; and (8) one Astatic Corporation crystal microphone, type JT-30. A block diagram of the circuit containing the above instruments may be seen in Figure 1, page 4.

The operation of the circuit may be described as follows: The speech signal was transmitted by the Altec Lansing microphone system to the input of the Magnecord amplifier unit. All signals for which synchronous feed-back was intended were transmitted to the subjects' earphones through an equalizer and channel 1 of the McIntosh amplifier. The equalizer served to equate the frequency response characteristics of the synchronous and delayed speech feedback channels. Signals which were transmitted to the subjects under delayed feedback conditions were coupled first from the Magnecord amplifier unit into the Magnecord recorder section which produced the side-tone delay, and the resulting delayed signal reached the subject by means of channel 2 of the McIntosh amplifier. Measurements of certain attributes of each subject's speech were obtained simultaneously on the Purdue Speech Sound Timer (a device from which certain rate-duration data may be obtained) and the model HPL-E power level recorder. Hewlett-Packard attenuators were placed in the circuits of these two instruments so that the speech signal voltages could be adjusted to obtain optimal recording performance.

In order to mask air and bone conduction auditory cues for simultaneous speech under the delayed-side-tone condition, and to effect as much change as possible in the speech of subjects, it was believed desirable to transmit a subject's speech back to him at a greatly increased intensity level (6). Empirically, a level was decided upon which appeared to be near the threshold for discomfort, but was still bearable. Computation revealed that, on the average, side-tone intensity for the 150 subjects was 46.6 db above input vocal intensity, with a standard deviation of 3.1 db. For synchronous feedback, this

level was 112.23 db, and for the delayed side-tone condition it was raised to 119.76 db.

It was mentioned earlier that the Magnecorder was modified so that it might be employed in delayed side-tone research. The chief modification consisted of the addition of a playback head to the recording unit as shown in Figure 2. The ERASE, RECORD, and new PLAYBACK heads of the recorder were arranged so that a 42 inch loop of recording tape would travel first over the erase head which removed all previously recorded signals. The tape then passed over the recording head. The playback head then picked up these recorded signals which were transmitted back to the talker. The playback head was mounted so that it could be moved in a line from .93 to 6.10 inches from the record head. The distance between the playback and record heads and the tape speed determines time delay between the impressing of a signal by the record head and the feedback of that signal through the playback head. The panel on which the playback head was mounted was calibrated in steps of .031 second from a delayed feedback time of .062 second to .406 second when the tape speed was 15 inches per second. A delay time of .187 second was used in the present study.



#### Identification of Components

(1) 1/8" aluminum plate, slotted (3) to permit spring (4) mounted tape guide (2) (the spring employed is a coping saw blade) to slide fully from left to right to help provide mechanical filtering of variations in tape speed and to assure uniform contact pressure of tape with respect to erase (6), record-playback (7), and variable playback (9) heads. (8) is a two head assembly. (2), (9), (10), and (11) are MagneCORD tape guide roller assemblies. (12) and (13) are capstan and pressure roller, respectively. (14) is a fixed mount for the coping saw blade.

FIGURE 2. VARIABLE DELAYED-FEEDBACK MODIFICATION OF MAGNECORD PT6-A

## APPENDIX D

### STATISTICAL TREATMENT OF THE DATA

Table I presents the group means on the voice variables for the two feedback conditions. Actually all the subjects without exception revealed an increase in Syllable Duration, Percent Phonation Time and Mean Vocal Intensity under the delayed feedback condition. In the case of Vocal Intensity Variance, 90 of the subjects increased their intensity variance while the remaining 30 manifested a decrease. As indicated by the significance tests presented in Table I, the delayed condition did significantly affect the voice variables under study.

In order to obtain the degree of relationship between the personality examination scores and the vocal difference scores, Pearson product-moment correlations were computed. Where further analysis appeared fruitful by varying the combinations of the personality measures to predict a voice variable change, the Wherry-Doolittle test selection method was employed. The results of this analysis are as follows:

1. Of the voice variables studied, only Vocal Intensity Variance demonstrated any consistent relationship with personality. None of the rate-duration measures or Mean Vocal Intensity revealed any note-worthy or consistent relationships with the personality scores.
2. Self-percept stability and vocal change were definitely related as indicated in Tables II and III by 19 significant correlations between the voice variable scores and the scale scores from the California and STDCR tests of personality. Four significant relationships were obtained in the reverse direction. The most noticeable tendency revealed by the analysis, however, was for Vocal Intensity to become more variable as self-percepts and social adjustments became poorer, possibly reflecting loss of control over Vocal Intensity as the self-conceptual system became more unstable.
3. In the case of schizoid modes of thought, Table IV reveals that Vocal Intensity Variance tended to decrease as Schizoid Tendencies increased. Since social introversion is regarded as one aspect of schizoid behavior, additional support for this finding may be derived from the significant relationship obtained between decreasing Vocal Intensity Variance and the Social Introversion Scale of the STDCR as shown in Table III. In other words, constrictive tendencies were manifested by the development of monotonous vocal intensity characteristics.
4. A significant correlation of .252 as shown in Table V was obtained between increasing Vocal Intensity Variance and the Paranoia scale of the MMPI. Of the six correlations computed, only those two relating to Vocal Intensity Variance revealed any significance.

Table I

A Comparison of Means for the  
Vocal Intensity and Vocal Rate-Duration Measures  
Obtained under Conditions of  
Synchronous and Delayed Speech Feedback

(N = 129)

<u>Voice Variable</u>	<u>Synchronous Feedback</u>	<u>Delayed Feedback</u>	<u>t-ratio</u>
Percent Phonation Time	49.31	72.62	11.656 <sup>1</sup>
Average Syllable Duration (Seconds)	.123	.284	9.081 <sup>1</sup>
Mean Intensity (in db above an arbitrary reference)	19.085	28.365	14.943 <sup>1</sup>
Intensity Variance (db) <sup>2</sup>	7.630	10.535	4.035 <sup>1</sup>

<sup>1</sup>Indicates significance beyond the .01 level of confidence.

<sup>2</sup>In order to test for the significance of the differences between the means of intensity variances for two correlated series as above, the original data were transformed to logarithms, and the formula specified by Peters and Van Voorhis (13, p. 182) was applied.

Table II  
Coefficients of Correlation between Voice Variable Measures  
and the factors of the California Test of Personality

<u>California Test of Personality Factors</u>		<u>Voice Variable Measure</u>					
<u>Scale</u>	<u>Factors</u>	1	2	3	4	5	6
la	Self-Reliance	.005	-.154 <sup>2</sup>	.018	-.195 <sup>2</sup>	-.282 <sup>3</sup>	.076
lb	Sense of Personal Worth	.062	-.035	-.014	-.036	-.026	-.112
lc	Sense of Personal Freedom	.204 <sup>2</sup>	.074	.192 <sup>2</sup>	.122	.054	.313 <sup>2</sup>
ld	Feeling of Belonging	-.016	.010	-.054	-.054	-.041	-.192
le	Freedom from Withdrawing Tendencies	.092	.013	.098	-.197 <sup>2</sup>	-.204 <sup>2</sup>	.128
lf	Freedom from Nervous Symptoms	.092	-.029	-.011	-.205 <sup>3</sup>	-.274 <sup>3</sup>	.033
	SELF ADJUSTMENT	.112	.113	.063	.187 <sup>2</sup>	-.235 <sup>3</sup>	.208 <sup>2</sup>

TABLE II CONTINUED ON NEXT PAGE

Table II (Continued)

California Test of Personality Factors      Voice Variable Measures<sup>1</sup>

<u>Scale</u>	<u>Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
2a	Social Standards	.006	-.097	.034	-.034	-.011	-.085
2b	Social Skills	-.038	-.087	-.012	-.219 <sup>3</sup>	-.203 <sup>2</sup>	-.142
2c	Freedom from Anti-Social Tendencies	-.057	-.060	.064	-.126	-.148	.140
2d	Family Relations	.003	.014	-.005	-.038	-.008	-.086
2e	School Relations	-.005	-.037	.033	-.020	-.006	-.155
2f	Community Relations	-.116	-.139	-.026	-.100	-.200 <sup>2</sup>	-.228
	SOCIAL ADJUSTMENT	-.072	-.099	-.030	-.157 <sup>2</sup>	-.129	-.232
	TOTAL ADJUSTMENT	.028	-.066	.024	-.184 <sup>2</sup>	-.196 <sup>2</sup>	-.089

<sup>1</sup>The voice variable measures are coded as follows: 1 = Percent phonation time, 2 = Syllable Duration, 3 = Mean Vocal Intensity, 4 = Degree of change in Vocal Intensity Variance, 5 = Degree of Increasing Change in Vocal Intensity Variance, 6 = Degree of Decreasing Change in Vocal Intensity Variance.

<sup>2</sup>Indicates significance at or beyond the .05 level of confidence.

<sup>3</sup>Indicates significance at or beyond the .01 level of confidence.

5. As shown in Table VI, extremists on the Ethnocentric scale demonstrated better control of intensity variation under the delayed feedback condition. In other words, rigidity as defined in this study, appears to be negatively rather than positively related to vocal change under delayed feedback. It may be that the delay condition does not place enough stress to produce the hypothesized "looseness and breakdown", and consequently, the rigidity defenses were quite adequate for coping with the stress situation.

6. Utilizing the Wherry-Doolittle procedure, it was found that three of the relationships shown in Table VII (Social Introversion, Sense of Personal Freedom and Schizophrenia) made significant contributions to vocal change. A multiple correlation of .584 was obtained between a combination of these three measures and decreasing Vocal Intensity Variance. Thus, there appears to be a positive relationship between schizoid behavior and voice variable change.

Table VII also presents the results of a similar analysis to predict increasing Vocal Intensity Variation. Six personality measures accounted for the greatest change in the voice variables. The resulting multiple correlation coefficient was .491.

Table III  
Coefficients of Correlation  
between Voice Variable Measures and  
the Subtests of an Inventory of Factors STDCR

Subtests of an Inventory of Factors STDCR	Voice Variable Measures <sup>1</sup>					
	1	2	3	4	5	6
S	.019	.081	.005	.157 <sup>2</sup>	.155	.360 <sup>2</sup>
T	.028	.026	.002	.115	.163	.031
D	-.022	.092	-.021	.212 <sup>3</sup>	.248 <sup>3</sup>	.144
C	.022	.050	.032	.124	.194 <sup>2</sup>	.009
R	.027	-.132	.022	-.096	.088	.032

<sup>1</sup>The voice variable measures are coded as follows:

- 1 = Percent Phonation Time,
- 2 = Syllable Duration,
- 3 = Mean Vocal Intensity,
- 4 = Degree of Change in Vocal Intensity Variance,
- 5 = Degree of Increasing Change in Vocal Intensity Variance
- 6 = Degree of Decreasing Change in Vocal Intensity Variance.

<sup>2</sup>Indicates significance at or beyond the .05 level of confidence.

<sup>3</sup>Indicates significance at or beyond the .01 level of confidence.

Table IV

Coefficients of Correlation between  
Voice Variable Measures and Schizophrenia Scale Scores

	Voice Variable Measures <sup>1</sup>					
	1	2	3	4	5	6
Sc Scale	.018	.053	.065	.135	.131	.306 <sup>2</sup>

<sup>1</sup>The voice variable measures are coded as follows:

- 1 = Percent Phonation Time,
- 2 = Syllable Duration,
- 3 = Mean Vocal Intensity,
- 4 = Degree of Change in Vocal Intensity Variance,
- 5 = Degree of Increasing Change in Vocal Intensity Variance,
- 6 = Degree of Decreasing Change in Vocal Intensity Variance.

<sup>2</sup>Indicates significance at the .05 level of confidence.

Table V

Coefficients of Correlation between  
Voice Variable Measures and Paranoia Scale Scores

	<u>Voice Variable Measures<sup>1</sup></u>					
	1	2	3	4	5	6
Pa Scale	-.051	-.078	.017	.193 <sup>2</sup>	.252 <sup>3</sup>	.080

<sup>1</sup>The voice variable measures are coded as follows:

- 1 = Percent Phonation Time,
- 2 = Syllable Duration,
- 3 = Mean Vocal Intensity,
- 4 = Degree of Change in Vocal Intensity Variance,
- 5 = Degree of Increasing Change in Vocal Intensity Variance,
- 6 = Degree of Decreasing Change in Vocal Intensity Variance.

<sup>2</sup>Indicates significance beyond the .05 level of confidence.

<sup>3</sup>Indicates significance beyond the .01 level of confidence.

Table VI

Coefficients of Correlation between  
Voice Variable Measures and E-Scale Scores

E-Scale Scores	Voice Variable Measures <sup>1</sup>					
	1	2	3	4	5	6
Total E-Scale Score	.041	.017	.015	.039	-.085	.053
Number of + 3's	-.113	-.143	-.058	-.154 <sup>2</sup>	-.171 <sup>2</sup>	-.054
Number of - 3's	-.137	-.059	-.040	-.168 <sup>2</sup>	-.245 <sup>3</sup>	.103
Total Number of 3's	-.188 <sup>2</sup>	-.129	-.070	-.237 <sup>2</sup>	-.318 <sup>2</sup>	.077

<sup>1</sup>The voice variable measures are coded as follows:

- 1 = Percent Phonation Time
- 2 = Syllable Duration,
- 3 = Mean Vocal Intensity,
- 4 = Degree of Change in Vocal Intensity Variance,
- 5 = Degree of Increasing Change in Vocal Intensity Variance,
- 6 = Degree of Decreasing Change in Vocal Intensity Variance.

<sup>2</sup>Indicates significance at or beyond the .05 level of confidence.

<sup>3</sup>Indicates significance at or beyond the .01 level of confidence.

Table VII  
Multiple Correlation Coefficients between  
Vocal Intensity Variability Change and  
Various Personality Scales  
Computed by the Wherry-Doolittle Test Selection Method

<u>Test Factors and Combinations</u>	<u>R</u>
Increasing Vocal Intensity Variation and:	
A	.318
A + B	.402
A + B + C	.460
A + B + C + D	.482
A + B + C + D + E	.489
A + B + C + D + E + F	.491
Decreasing Vocal Intensity Variation and:	
G	.360
G + H	.517
G + H + I	.534

The test factors code which was employed above is as follows:

- A = total number of 3's on the E-scale.
- B = the Paranoia scale of the MMPI.
- C = the Self-Reliance Scale of the California Test of Personality
- D = the Community Relations Scale of the California Test of Personality.
- E = the Freedom from Nervous Symptoms Scale of the California Test of Personality.
- F = the number of 3's on the E-scale.
- G = the Social Introversion Scale of an Inventory of Factors STDCR.
- H = the Sense of Personal Freedom Scale of the California Test of Personality, and
- I = the Schizophrenia Scale of the MMPI.

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